



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/667,390	09/23/2003	Tongbi Jiang	M4065.0906/P906	9376
24998	7590	02/08/2006	EXAMINER	
DICKSTEIN SHAPIRO MORIN & OSHINSKY LLP			WYATT, KEVIN S	
2101 L Street, NW			ART UNIT	
Washington, DC 20037			PAPER NUMBER	
			2878	

DATE MAILED: 02/08/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/667,390

Applicant(s)

JIANG ET AL.

Examiner

Kevin Wyatt

Art Unit

2878

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 November 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 48-74 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 48-55, 64-72 and 74 is/are rejected.
- 7) ☒ Claim(s) 56-59 and 73 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 23 September 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☐ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____

DETAILED ACTION

1. This Office Action is in response to the amendment and remarks filed on 11/23/2005. Currently, claims 48-74 are still pending.

Drawings

2. The drawings are objected to because figures and reference numbers are hand written. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.
3. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference characters "20", "21", "50", and "13", "12" in Fig. 3, and reference

characters "20", "21", "32" in Fig. 3a, all have been used to designate the same elements. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless -

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 48-55, 60-61, 64-72 and 74 are rejected under 35 U.S.C. 102(b) as being anticipated by Fukusyo (U.S. Patent No. 6,066,511).

Regarding claim 48, Fukusyo shows in Figs. 1, and 2A-C, a method of fabricating an image sensor (20, i.e., imaging device) the method comprising: providing a substrate (2, i.e., substrate) comprising a plurality of photosensitive regions (3, i.e., photosensing portion) having photo sensors, and an upper substrate layer; providing a color filter

Art Unit: 2878

array (12, i.e., color filter) on top of the upper substrate layer; applying a sacrificial material to the upper substrate layer (col. 5, lines 2-7); forming support molds (i.e., combination of interlayer insulating film (9), light shielding film (10) and overcoat layer (21)) in the sacrificial material; forming lens molds (22, i.e., recessed portion between support molds beneath overcoat layer) in the sacrificial material; forming supports (transfer electrode (8)) by filling the support molds with a support material (21, i.e., overcoat layer); forming a first micro-lens array having first micro-lenses by filling the lens molds with a first micro-lens material (21 and 24, i.e., overcoat layer and lens layer); and removing the sacrificial material (col. 5, lines 2-7).

Regarding claim 49, Fukusyo shows in Figs. 2A and 2B a method of applying a sacrificial photo resist to the sacrificial material (col. 5, lines 2-7); applying a mask to the sacrificial photo resist and exposing support openings in the sacrificial photo resist (col. 5, lines 2-7); and etching the sacrificial material by applying a chemical etching solution to form support (i.e., combination of interlayer insulating film (9), light shielding film (10) and overcoat layer (21)) by etching through the support openings (col. 5, lines 2-7).

Regarding claim 50, Fukusyo discloses that the chemical etching solution is an anisotropic etching solution (col. 5, lines 2-7).

Regarding claim 51, Fukusyo shows in Figs. 2A and 2B a method comprising: applying a sacrificial photo resist to the sacrificial material (col. 5, lines 2-7); applying a mask to the sacrificial photo resist and exposing sacrificial resist openings in the sacrificial photo resist (col. 5, lines 2-7); etching the sacrificial material by applying a chemical etching solution to form lens molds (i.e., recessed portion beneath overcoat

layer (21)) by etching through the sacrificial resist openings; and applying a rinse to stop the etching process (col. 5, lines 2-7).

Regarding claim 52, Fukusyo discloses that the chemical etching solution is an isotropic etching solution (col. 5, lines 2-7).

Regarding claim 53, Fukusyo discloses that the step the forming the support molds further comprises etching the support molds in the sacrificial material by controlled laser etching (i.e., thermal oxidation)(col. 5, lines 2-7).

Regarding claim 54, Fukusyo discloses that the step forming the lens molds (i.e., recessed portion beneath overcoat layer (21)) further comprises etching the lens molds in the sacrificial material by controlled laser etching (i.e., thermal oxidation)(col. 5, lines 2-7).

Regarding claim 55, Fukusyo discloses a method wherein said sacrificial material degrades upon heating to a degradation point, and the step of removing the sacrificial material comprises heating (i.e., thermal oxidation) the sacrificial material to at least the degradation point (col. 5, lines 2-7).

Regarding claim 60, Fukusyo discloses a method wherein said removing the sacrificial material comprises treating the sacrificial material with chemical resist solvents (col. 5, lines 2-7).

Regarding claim 61, Fukusyo shows in Figs. 1, and 2A-C a method wherein the support material is the first micro-lens material (21, i.e., overcoat layer).

Regarding claim 64, Fukusyo shows in Figs. 1, and 2A-C a method of fabricating an image sensor, the method comprising; providing a substrate comprising (2, i.e.,

substrate) a plurality of photosensitive regions (3, i.e., photosensing portion) having photo sensors, and an upper substrate layer; applying a sacrificial material (combination of interlayer insulating film (9), light shielding film (10) and overcoat layer (21)) above the upper substrate layer; forming lens molds (22, i.e., recessed portion between support molds beneath overcoat layer) in the sacrificial material; forming a micro-lens array having micro-lenses by filling the lens molds with a micro-lens material (21 and 24, i.e., overcoat layer and lens layer); and removing the sacrificial material (col. 5, lines 2-7).

Regarding claim 65, Fukusyo shows in Figs. 2A and 2B, a method comprising: forming support molds (i.e., portion of lens layer (24) covering overcoat layer (21)) in the sacrificial material; and forming supports (transfer electrode (8)) by filling the support molds with a support material.

Regarding claim 66, Fukusyo shows in Figs. 2A and 2B, a method comprising: applying a sacrificial photo resist to the sacrificial material (col. 5, lines 2-7); applying a mask to the sacrificial photo resist and exposing support openings in the sacrificial photo resist (col. 5, lines 2-7); and etching the sacrificial material by applying an chemical etching solution to form support molds (i.e., combination of interlayer insulating film (9), light shielding film (10) and overcoat layer (21)) by etching through the support openings (col. 5, lines 2-7).

Regarding claim 67, Fukusyo discloses that the chemical etching solution is an anisotropic etching solution (col. 5, lines 2-7).

Regarding claim 68, Fukusyo shows in Figs. 2A and 2B, a method comprising: applying a sacrificial photo resist to the sacrificial material (col. 5, lines 2-7); applying a mask to the sacrificial photo resist and exposing sacrificial resist openings in the sacrificial photo resist (col. 5, lines 2-7); etching the sacrificial material by applying a chemical etching solution to form lens molds (22, i.e., recessed portion between support molds beneath overcoat layer) by etching through the sacrificial resist openings (col. 5, lines 2-7); and applying a rinse to stop the etching process (col. 5, lines 2-7).

Regarding claim 69, Fukusyo discloses a method wherein the chemical etching solution is an isotropic etching solution (col. 5, lines 2-7).

Regarding claim 70, Fukusyo discloses a method wherein the step the forming the lens molds further comprises etching the lens molds in the sacrificial material by controlled laser etching (col. 5, lines 2-7).

Regarding claim 71, Fukusyo discloses a method wherein said sacrificial material degrades upon heating to a degradation point, and the step of removing the sacrificial material comprises heating (i.e., thermal oxidation) the sacrificial material to at least the degradation point (col. 5, lines 2-7).

Regarding claim 72, Fukusyo discloses a method wherein method of claim 65 wherein the step of the forming the support molds further comprises etching the support molds in the sacrificial material by controlled laser etching (i.e., thermal oxidation)(col. 5, lines 2-7).

Regarding claim 74, Fukusyo shows in Figs. 2A and 2B, a method wherein the support material is the micro-lens material (21, i.e., overcoat layer).

4. Claims 62-63 are rejected under 35 U.S.C. 102(b) as being anticipated by Burger (U.S. Patent No. 6,381,072).

Regarding claim 62, Burger shows in Fig. 2, a method of fabricating an image sensor, the method comprising: providing a substrate (substrate (54a) and substrate of ccd array (40)) having a plurality of photo sensors; forming one or more supports (opto-mechanical fixture (58), spacing elements (62) and edges (60)) having distal and proximal ends wherein the distal ends are proximate the substrate (54a, i.e., substrate); and forming a first micro-lens array in association with the substrate, the first micro-lens array having micro-lenses corresponding to said photo sensors and (56e, i.e., refractive lenslet array) supported by the supports at said proximal ends wherein a cavity (i.e., area between substrate 54b and substrate 54a) is formed between said first micro-lens array and said substrate.

Regarding claim 63, Burger shows in Fig. 2, a method comprising forming a second micro-lens array (56c, i.e., non-refractive lenslet array) above the substrate (54a, i.e., substrate) and below the first micro-lens array wherein the distal ends of the supports are adjacent to the second micro-lens array and the cavity is formed above said second micro-lens array (col. 22, line 36).

Allowable Subject Matter

7. Claims 56-59, and 73 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

8. The following is a statement of reasons for the indication of allowable subject matter:

Claims 56 and 73 have allowable subject matter because the prior art fails to disclose or make obvious, either singly or in combination, a method of fabricating an image sensor comprising, in addition to the other cited features of the claim, forming vacuum channels through the first micro-lens array wherein the distal ends of the vacuum channels are adjacent the sacrificial material; and using the vacuum channels to remove residual particles that remain in the image sensor after the step of removing the sacrificial material.

Response to Arguments

9. Applicant's arguments filed on 11/23/2005 have been fully considered but they are not persuasive.

In response to applicant's argument that Fukusyo does not disclose the recited steps of claim 48. The examiner disagrees.

The method of providing a substrate comprising a plurality of photosensitive regions having photo sensors, and an upper substrate layer is shown in Figs. 2A-C. The photosensitive regions are the plurality photosensing portions (3) and the upper substrate layer is the layer (overcoat layer (21) which is immediately under the sacrificial

material). The method of providing a color filter array (12) on top of the upper substrate layer is disclosed in col. 1, line 53; applying a sacrificial material (24, i.e., lens layer) to the upper substrate layer is disclosed or disclosed in col. 4, line 42-46 and shown in Fig.2B. The method of forming support molds (combination of light shielding film (10) and insulating film (9), overcoat layer (21)) in the sacrificial material is disclosed in col. 4, lines 4-8, and 48-51; forming lens molds (22, i.e., recessed portion) in the sacrificial material is disclosed in col. 5, lines 23-27 and shown in Fig. 2A. The method of forming supports (transfer electrode (8)) by filling the support molds (contour of the surface of light shielding film (10) and insulating film (9)) with a support material (21, i.e., overcoat layer) is disclosed in col. 5, lines 8-12 and shown in Fig. 2B. The method of forming a first micro-lens array having first micro-lenses by filling the lens molds (22, i.e., recessed portion) with a first micro-lens material (23, i.e., lens portion); and removing the sacrificial material (24, i.e., lens layer) is disclosed col. 5, lines 28-32 and shown in Fig. 2C.

In response to applicant's argument that Fukusyo does not disclose the recited steps of claim 64. The examiner disagrees.

The method of providing a substrate (2) comprising a plurality of photosensitive regions having photo sensors, and an upper substrate layer is disclosed in col. 1, lines 33-35 and 40-41 and Fig. 1. The method of applying a sacrificial material (24, i.e., lens layer) above the upper substrate layer is disclosed in col. 4, line 42-46 and shown in Fig.2B. The method of forming lens molds (22, i.e., recessed portion) in the sacrificial material (24, i.e., lens layer) is disclosed in col. 5, lines 28-32, and shown Fig. 2C. The

Art Unit: 2878

method of forming a micro-lens array having microlenses (micro on-chip lens) by filling the lens molds (22, i.e., recessed portion) with a micro-lens material (23, i.e., lens portion) and removing the sacrificial material (24, i.e., lens layer) is disclosed in col. 5, lines 28-32 and shown in Fig. 2C. Therefore, Fukusyo fully discloses the methods of independent claims 48 and 64.

In response to applicant's argument that burger fails to disclose or suggest the subject matter and limitations of claims 62 and 63. The examiner disagrees. The methods of a) providing a substrate having a plurality of photo sensors; b) forming one or more supports, having distal and proximal ends wherein the distal ends are proximate the substrate; c) and forming a first micro-lens array in association with the substrate, the first micro-lens array having micro-lenses corresponding to said photo sensors and supported by the supports at said proximal ends wherein a cavity is formed between said first micro-lens array and said substrate, are fully disclosed in Fig. 2.

Thus, the rejection of claims 48-55, 60-72 and 74 are proper.

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the

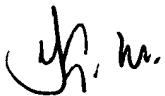
Art Unit: 2878

shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin Wyatt whose telephone number is (571)-272-5974. The examiner can normally be reached on Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Georgia Epps can be reached on (571)-272-2328. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



K.W.



Georgia Epps
Supervisory Patent Examiner
Technology Center 2800